Office of Technical Assistance Research Proposal

Air Cooled Condensers for Thermal Wastewater Evaporators

Background

Over the past decade, manufacturers in Massachusetts have been expected to achieve a higher degree of compliance with increasingly more stringent wastewater discharge standards. Concentration of non-volatile contaminants by evaporation has emerged as a viable alternative to treating wastewater for discharge. It may be even more compelling for companies that may require accumulation and transport to a POTW due to a more remote location without sewer services. Most thermal evaporators sold boil wastewater at atmospheric pressure, releasing the water vapor to the atmosphere and leaving a concentrated liquid waste for proper disposal. Evaporators are often used by businesses that want to reduce their wastewater disposal volumes, are unable to meet the local permissible discharge limits to the sewer, or are in a location where there is no sewer and therefore cannot discharge any wastewater.

Thermal evaporators are heated with natural gas, propane, steam, hot oil, or electricity to bring the wastewater to a full boil. After this heat is transferred to the wastewater in the tank, it is released up the stack and is not harnessed for additional use. An additional hidden cost is the excess air which is usually drawn from the room and mixed with the water vapor to reduce the potential for condensation in the stack or fogging upon exit from the building. If a company wants to condense and recover the water it is usually suggested that they add a condenser and auxiliary refrigeration or cooling tower thus doubling the capital and operating costs.

Scope of Problem

Currently, evaporators are designed for the single purpose of reducing wastewater volume to reduce transport and treatment costs. However, if most of the water vapor and expended heat energy could be more economically recovered and reused, the overall operating costs and environmental performance of thermal evaporators would be improved. This could be achieved by adding an air-cooled condenser to the stack of the thermal evaporator. The heat from the condensing water could be transferred to an area of the facility that needs to be heated in non-summer months, while on warmer days the condenser could be cooled directly with outside air.

It is estimated that evaporators are used by at least 50% of the metal finishing and electroplating industries in Massachusetts. Currently there are 118 companies listed in Standard Industrial Classification (SIC) Code 3471 (electroplating, plating, polishing, anodizing, coloring) and 98 in SIC 3479 (coating and engraving). Thus, it is probable that over 100 companies in these industries will be using evaporators to reduce their wastewater. Wastewater evaporation is not restricted to the metal finishing and electroplating industries either. Printing, silver film processing, and even the auto body industry have potential uses for evaporators. Therefore, there is potential for large energy savings and moderate water reuse in these industries.

Objective

This research project should identify any commercially available air-cooled condenser systems; if none are available, the project should develop an economical 10 gallon/hour air-cooled condenser system for atmospheric wastewater evaporators that can also be retrofitted to existing evaporators. OTA can help to identify an industry partner for this project.